Space Weather Technical Forecast

Issued on Friday, 17 March 2023 at 01:23 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity expected.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours with three isolated C-class flares, the largest a C1.4 at 16/1300UTC from AR3245. There are currently seven numbered and two unnumbered sunspot regions on the visible disc. The majority of the regions are small, weak and either stable or weakly decaying, with AR3255 now barely visible. However, a new spot on the southeast limb appears to be the largest sunspot on the disc, and may be the leader spot of a significant region which is yet to emerge.
No Earth directed CME's have been observed in the past 24-hours.

Solar Wind / Geomagnetic Activity: The solar wind started the period at elevated levels, reaching a peak at L1 of 588km/s at 16/0034 UTC. This was due to ongoing enhancement from the 15th March, attributed to CME arrivals combined with a HSS. Winds then gradually declined to slightly elevated levels, ending the period around 470km/s. Density has been predominantly at average levels. The total IMF strength persisted at weak levels. The north-south component Bz was also weak, with a maximum southward component of -3nT at 16/0213 UTC. The Phi angle was mostly positive (away from the Sun) but occasionally switched to negative. Geomagnetic activity was initially Active (Kp 4) but quickly decreased to Quiet levels (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at close to background, with a peak of 1.3pfu at 16/0155UTC. The high energy electron flux (greater than 2MeV) has been at background to moderate levels, with a peak of 136pfu at 16/2340UTC. The associated 24 hour Electron fluence has been well below Active (1e10 integrated flux), but with an increasing trend. At 17/0001UTC the observed fluence was 1.92e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain Low or Very Low, with a slight chance of an isolated M-class flare, most probable from day 3 (19th) as new regions are expected to arrive from the far side.

Solar Wind / Geomagnetic Activity: Solar winds are expected to remain at slightly elevated levels through Days 1-2 (17-18 Mar) under the waning influence of coronal hole high speed stream effects and CME influence from arrivals on 15th Mar. Wind speeds continue to decline through Day 3 to reach background levels. Then a weak enhancement is possible late Day 3 (19 Mar), more likely through Day 4 (20th), as connection to a HSS from CH85/+ becomes established. No Earth directed CME's are expected during the forecast period.

Geomagnetic conditions are forecast to be largely Quiet (Kp 0-1), with a chance of isolated Unsettled (Kp 3) intervals until late day 3 and through day 4. Then becoming Unsettled to Active (Kp 3-4) with a slight chance of a G1/Minor Storm interval.

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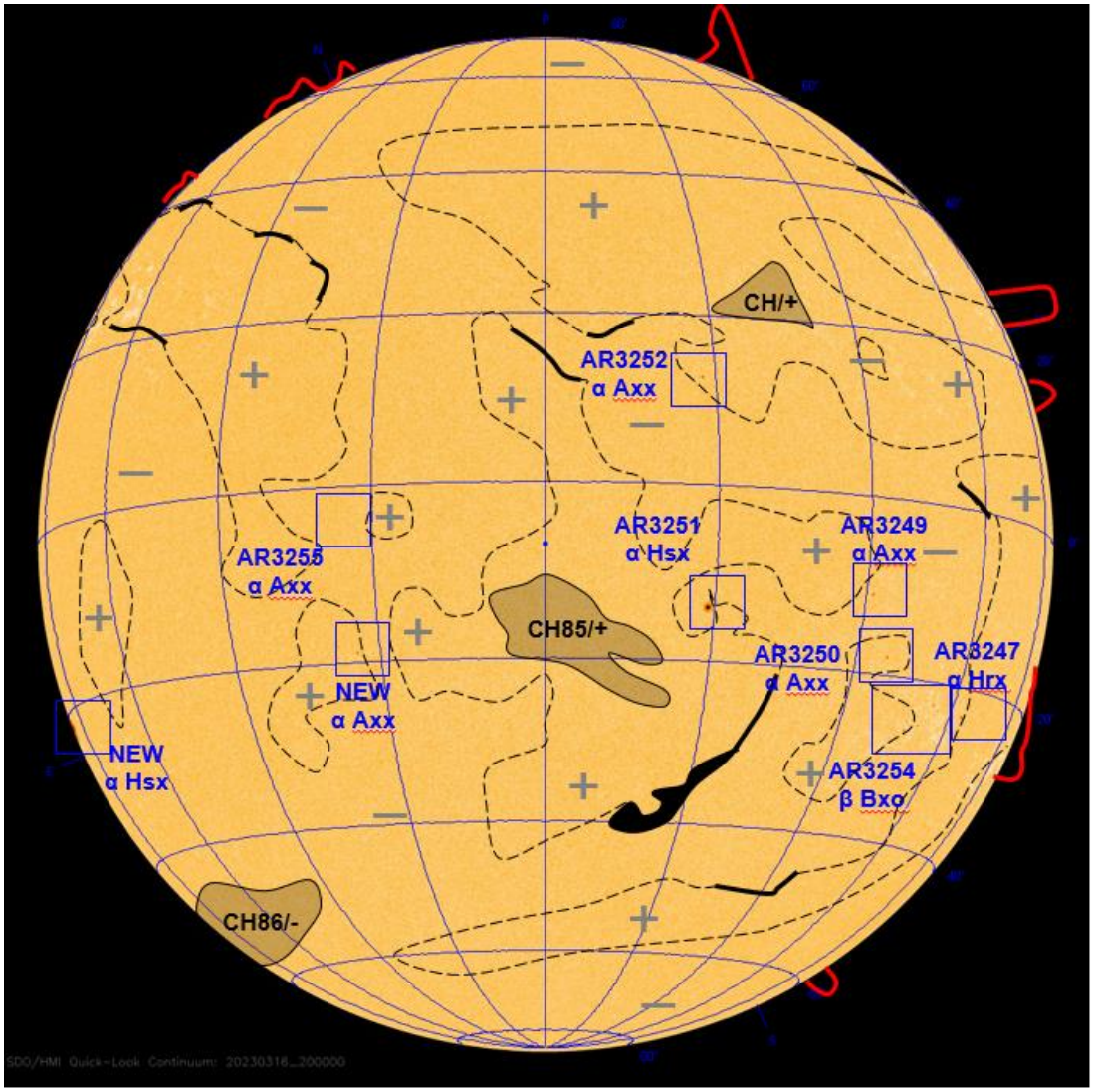
Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux, as observed by GOES16, is expected to remain at or near background levels throughout. No further significant enhancements are expected at present. The high energy electron flux is expected to persist at largely Background levels on Day 1 (17 Mar), but is then likely to increase slightly through the rest of period. Flux levels are expected to reach predominantly Moderate levels, with a chance of reaching High levels by late Day 2 (18 Mar). The associated 24 hour electron fluence is expected to persist at below the Active level (1e8 integrated flux), but with an upward trend.

Figure 1. Solar Analysis Valid 16/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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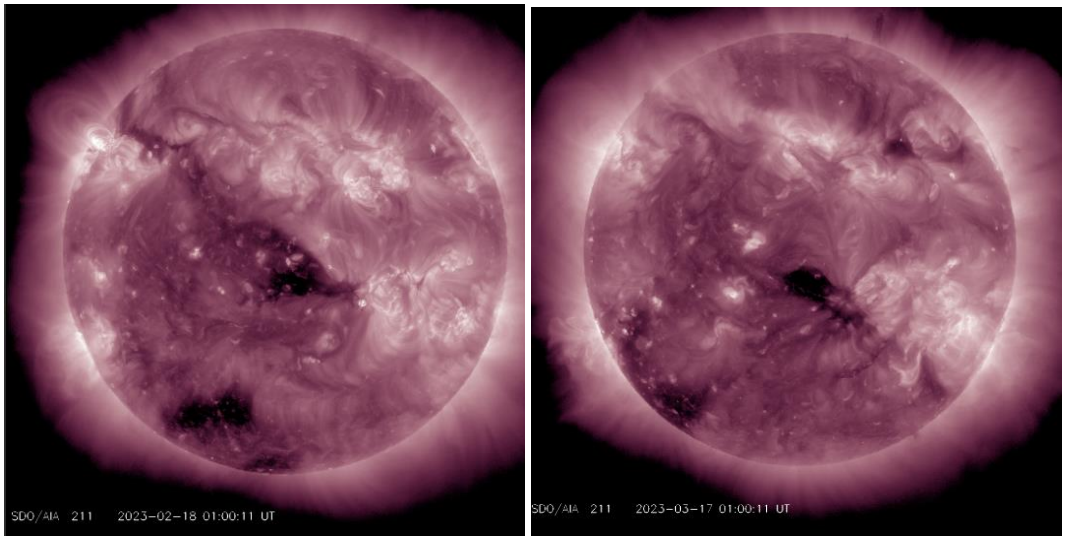
Geomagnetic Storms:

The solar wind is currently around 460 km/s. Solar winds are expected to remain at slightly elevated levels through Days 1-2 (17-18 Mar) under the waning influence of coronal hole high speed stream effects and CME influence from arrivals on 15th Mar. Wind speeds continue to decline through Day 3 to reach background levels. Then a weak enhancement is possible late Day 3 (19 Mar), more likely through Day 4 (20th), as connection to a HSS from CH85/+ becomes established. This coronal hole feature is small, and appears to be in a similar size and position compared to the previous rotation when winds speeds of around 450 km/s where achieved. Therefore CH85 does not appear to be a significant coronal hole feature, leading to only a slight chance of significant geomagnetic activity. No Earth directed CME's are expected during the forecast period.

Geomagnetic conditions are forecast to be largely Quiet (Kp 0-1), with a chance of isolated Unsettled (Kp 3) intervals until late day 3 and through day 4. Then becoming Unsettled to Active (Kp 3-4) with a slight chance of a G1/Minor Storm interval.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: SDO/AIA 211 imagery (previous rotation left and recent image right) showing CH85 near centre disc.



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Radio Blackouts - X-Ray Flares:

Solar activity has been Low over the past 24 hours with three isolated C-class flares, the largest a C1.4 at 16/1300UTC from AR3245. There are currently seven numbered and two unnumbered sunspot regions on the visible disc. The majority of the regions are small, weak and either stable or weakly decaying, with AR3255 now barely visible. However, a new spot on the southeast limb appears to be the largest sunspot on the disc, and may be the leader spot of a significant region which is yet to emerge. In addition to the spots, there are number of filaments on the disc, which should any erupt, could be another source of C-class flares.

Solar activity is expected to remain Low or Very Low, with a slight chance of an isolated M-class flare. These are most probable from day 3 (19th) as new or returning regions are anticipated to rotate around the eastern limb, bringing an associated increase in flare risk.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Solar Radiation Storms - (High Energy Protons):

High energy (greater than 10 MeV) proton flux, as observed by GOES16, is expected to remain at background or slightly elevated levels throughout the forecast period.
Given the simplicity of the sunspot regions currently on the disc, no further significant enhancements are expected, unless any further large far-sided eruptions occur.

Radiation Storms	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ S1	No	5	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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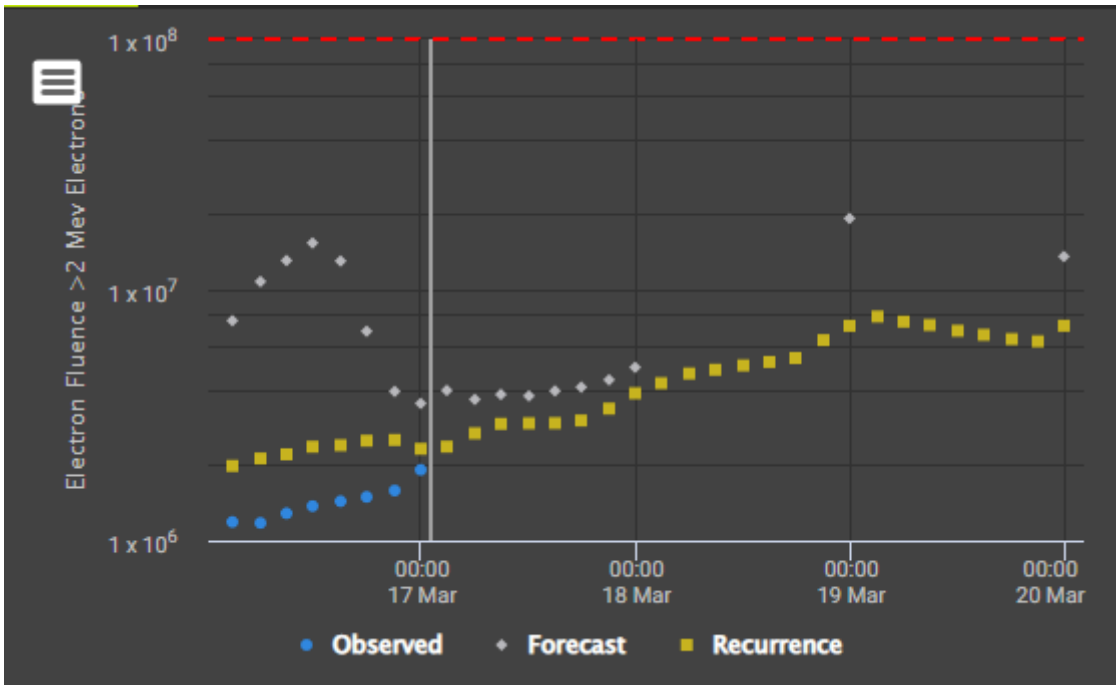
High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux at GEO, as observed by GOES-16, is expected to persist at largely Background levels on Day 1 (17 Mar), but is then likely to increase slightly through the rest of period. Flux levels are expected to reach predominantly Moderate levels, with a chance of reaching High levels by late Day 2 (18 Mar).

The associated 24 hour electron fluence is expected to remain below the Active level, gradually trending upwards during Days 2-4 (17-19 Mar), with only a slight chance of the Active threshold being reached late in the period. Therefore the REFM is currently considered to be giving good guidance for the overall forecast trend.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	5	10	20	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 3: Met Office REFM.



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